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IDENTIFICATION OF ECOLOGICALLY AND BIOLOGICALLY SIGNIFICANT AREAS (EBSAS) IN THE OFFSHORE PACIFIC BIOREGION

Figure 1. Features identified as ecologically and biologically significant areas (EBSAs) within the Offshore Pacific Bioregion: hydrothermal vents; seamounts, continental slope, Haida Eddy, and the North Pacific Transition Zone (NPTZ). EBSA boundaries are depicted in Figures 2, 3, 4, and 5.

Context:

As a signatory to the Convention on Biological Diversity (CBD), Canada has committed to identifying and managing Ecologically or Biologically Significant Areas (EBSAs) within its marine waters. Canada's Oceans Act (1997) provides the legislative framework for an integrated ecosystem approach to management in Canada's oceans, particularly in areas considered ecologically or biologically significant. DFO has developed guidance for the identification of EBSAs (DFO 2004, 2011), and has endorsed the scientific criteria used by the CBD for identifying marine EBSAs as defined in Annex I of Decision IX/20 of its 9th Conference of Parties (UNEP/CBD 2008). EBSAs were recently identified in Canadian Pacific waters from the coast to the shelf break (DFO 2013). Further, EBSAs were identified in international waters of the North Pacific Ocean at a CBD workshop held in Moscow, Russian Federation, in March 2013 (CBD 2014). EBSAs identified in both processes are contiguous with features in Canada's Offshore Pacific Bioregion. However, Canadian waters from the shelf break to the Exclusive Economic Zone (EEZ) boundary were unassessed against EBSA criteria. As such, this CSAS process was undertaken to fill this gap.

This Science Advisory Report is from the February 11-12, 2015, Identification of Ecologically and Biologically Significant Areas (EBSAs) in the Pacific Offshore Bioregion. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

SUMMARY

- Six areas or types of features within the Offshore Pacific Bioregion were assessed against a combination of national (Fisheries and Oceans Canada, DFO) and international (Convention on Biological Diversity, CBD) criteria for identifying Ecologically and Biologically Significant Areas (EBSAs). The areas or types of features evaluated

encompassed most marine habitats within the Offshore Pacific Bioregion, including those associated with hydrothermal vents, seamounts, the continental slope, the seafloor, and the water column from the seafloor to the surface, including bathypelagic and abyssal waters.

- The combined DFO-CBD methodology merged eight established DFO and CBD EBSA criteria and used an EBSA template adapted from the CBD to organize information. A feature or area was identified as an EBSA if it scored high on at least one of the three primary DFO criteria or if it scored above average (medium or high) across a range of criteria (i.e., cumulative importance; DFO 2004, 2011).
- Five EBSAs were confirmed in the Offshore Pacific Bioregion. They included all hydrothermal vents; all seamounts; the entire continental slope; the Haida Eddy; and the North Pacific Transition Zone (NPTZ). No EBSAs were identified in the bathypelagic and abyssal zones, although information was lacking for many criteria.
- New information should be incorporated into periodic assessments to refine identification of EBSAs and their boundaries.

INTRODUCTION

Canada's Oceans Act (1997) states that "conservation, based on an ecosystem approach, is of fundamental importance to maintaining biological diversity and productivity in the marine environment". The Act provides the legislative framework for an integrated ecosystem approach to management in Canada's oceans, particularly in areas considered ecologically or biologically significant. DFO developed guidance for the identification of Ecologically or Biologically Significant Areas (EBSAs) (DFO 2004, 2011), and has endorsed the scientific criteria used by the Convention on Biological Diversity (CBD) for identifying EBSAs as defined in Annex I of Decision IX/20 of its 9th Conference of Parties (UNEP/CBD 2008).

EBSAs have been confirmed in Canadian Pacific waters from the coast to the shelf break. Further, EBSAs were identified in international waters of the North Pacific Ocean at a CBD workshop held in Moscow, Russian Federation, in March 2013 (CBD 2014). EBSAs identified in both processes are contiguous with features in Canada's Offshore Pacific Bioregion. However, Canadian waters from the shelf break to the Exclusive Economic Zone (EEZ) boundary were unassessed against EBSA criteria. The current assessment was completed in response to a request to identify EBSAs within Canada's Offshore Pacific Bioregion. The application of CBD criteria was included in this analysis to align EBSA identification in the Offshore Pacific Bioregion with international evaluation processes.

EBSAs inform a broad range of management and policy decisions related to marine use in Canada's Oceans. EBSAs identified in the Offshore Pacific Bioregion's waters will serve as a key component of the knowledge base for a broad range of marine spatial planning processes, including:

i. the development of Canada's network of Marine Protected Areas (MPAs) under the Oceans Act and the Canada – British Columbia Marine Protected Area Network Strategy (Canada 2014),

ii. integrated management of human activities; and

iii. implementation of DFO's Sustainable Fisheries Framework under the Fisheries Act.

In addition, this information may be used by other federal Departments and the Province of British Columbia, who are responsible for the management of a myriad of activities that

influence marine ecosystems in this region (e.g., resource extraction, marine shipping, ocean dumping, spill response, cable laying, land use planning, etc.).

This Science Advisory Report provides science advice on the location and characteristics of areas that meet EBSA criteria in the Offshore Pacific Bioregion.

ASSESSMENT

DFO has established methods to identify and confirm potential EBSAs in Canadian waters (DFO 2004, 2011) and these have been applied in several marine bioregions across Canada, including Pacific Region (DFO 2013). These methods include the evaluation of a set of EBSA criteria: uniqueness, importance for aggregation, fitness consequences for species or life history stages, resilience, and naturalness (DFO 2004). In addition to the DFO EBSA criteria, the current assessment also utilized EBSA criteria developed internationally by the CBD: uniqueness, importance for species' life history stages, importance for threatened or endangered species, potential for recovery from disturbance, productivity, diversity, and naturalness (UNEP/CBD 2008). This assessment used a semi-quantitative, expert-reviewed process to assess information, rank the relative importance of areas or features against each of the eight EBSA criteria, and to determine whether or not a feature or area met the definition of an EBSA.

Criteria Assessment Methodology

The assessment included three phases. First, an information gathering phase was conducted through literature review and was assembled into a modified version of the EBSA evaluation template used by the CBD, with a provisional ranking for each criterion completed. Second, experts were engaged though the CSAS peer review process to review the information provided in the templates, the proposed criteria rankings, and identified EBSAs. Finally, experts in the peer review process were asked to review the proposed boundaries for features and areas identified as meeting EBSA criteria.

The CBD EBSA evaluation template was adapted to include DFO criteria and was used to organize available information and justify the associated criteria rankings. The modified CBD template included five sections: introduction; the location; a description of the evaluated area or feature; an overview of the feature/area's condition and future outlook; and a table where EBSA criteria were assessed and categorically ranked. A total of 8 EBSA criteria were evaluated including four that were unique to the CBD, one unique to DFO, and three that were assumed to be equivalent in both DFO and CBD processes (Table 1).

Table 1. Correspondence between DFO (2004) and CBD (2008) EBSA criteria, and the descriptions used to guide rankings.

DFO (ESR2004/006)	CBD (Annex 1 of Decision IX/20 of COPIX)	Description
Uniqueness	Uniqueness or rarity	Area contains either i. unique ("the only one of its kind"), rare (occurs only in few locations) or endemic species, populations or communities, and/or ii. unique, rare or distinct, habitats or ecosystems; and/or iii. unique or unusual geomorphological or oceanographic features.
Aggregation		Area where species aggregation occurs for important life cycle functions (breeding/spawning, rearing, feeding, migrating, etc.).
Fitness consequences	Special importance for life history stages or species	Area that is required for a population to survive and thrive. Areas that have important fitness consequences.
Resilience	Vulnerability, fragility, sensitivity, or slow recovery	Area that contains a relatively high proportion of sensitive habitats, biotopes or species that are functionally fragile (highly susceptible to degradation or depletion by human activity or by natural events) or with slow recovery.
Naturalness	Naturalness	Area with a comparatively higher degree of naturalness as a result of the lack of, or low level of, human-induced disturbance or degradation.
	Importance for threatened, endangered or declining species and/or habitats	Area containing habitat for the survival and recovery of endangered, threatened, declining species or area with significant assemblages of such species.
	Biological productivity	Area containing species, populations or communities with comparatively higher natural biological productivity.
	Biological diversity	Area containing comparatively higher diversity of ecosystems, habitats, communities, or species, or has higher genetic diversity.

In accordance with guidance by DFO (2004, 2011), the significance of each criterion was evaluated relative to other adjacent or surrounding areas in the bioregion. For example, biodiversity supported by hydrothermal vents was evaluated in relation to communities associated with the surrounding seafloor, while the productivity of seamounts was evaluated relative to the surrounding seafloor plains and pelagic waters. In the case of the continental

slope, because the area being evaluated was large and diverse and represented a bathypelagic transition area with distinct features that border two other bioregions, the surrounding areas were considered to be the continental shelf at the upper edge of the slope and the abyssal plain at the lower edge. The criterion of uniqueness was evaluated at both regional and global scales as recommended by DFO (2004, 2011).

Evaluation of the criterion related to importance for threatened or endangered species was based on formal species assessments and expert opinion, and an expanded definition to include species of special concern.

DFO science advice proposes that a feature or area that ranks as "high" for uniqueness, fitness consequences, or aggregation meets the criteria for EBSA identification. A feature or area that ranked relatively high (e.g. medium or high) across most criteria could also be identified as an EBSA (DFO 2004). This national science advice was applied during this peer review process.

In all assessments, each criterion was ranked as relatively low, medium or high in terms of importance compared to surrounding areas. For each criterion, rankings were based on the relative importance of an area based on the best available information, whether quantitative analysis, qualitative information, or expert knowledge. When there was uncertainty among participants about what a given rank should be (e.g. low vs medium), a decision was taken to assign the greater of the two ranks in keeping with the precautionary approach. This scenario arose for 4 of 48 rankings, but did not influence the overall assessment of areas as EBSAs. In cases where not enough information was available to assign a rank, a score of 'No information' was given. Measures of confidence were not applied to each of the preliminary or final rankings of criteria, or to decisions on whether or not an area or feature satisfied criteria for identification as an EBSA (as in DFO 2013), however this is recommended for future EBSA evaluations.

The DFO EBSA guidance recommends extrapolation from data-rich area(s) or feature(s) to similar areas or features with limited data (DFO 2011). This guidance was used to evaluate the significance of areas in the Offshore Pacific Bioregion that are under-sampled.

The methods to determine specific EBSA boundaries differed among identified EBSAs based on available knowledge/data and are described briefly for each EBSA below.

Results

Five types of features or areas met criteria for identification as EBSAs, as determined by a 'high' ranking of at least one of DFO's three primary criteria (Table 2), and by virtue of the fact that they scored medium or high on most criteria. No EBSAs were identified in the Bathypelagic and Abyssal Zone, in part due to insufficient information and because the available information did not support EBSA identification at this time.

Table 2. Summary of EBSA criteria rankings and overall EBSA assessment (See Table 1 for definitions of the criteria used in the assessments).

Criteria	Hydrothermal Vents	Seamounts	Continental Slope	Haida Eddy	North Pacific Transition Zone	Abyssal Zone
Uniqueness/Rarity (DFO/CBD)	High	High	Medium	High	Medium	Low
Fitness (DFO/CBD)	High	Medium	High	Medium	High	No Information
Threatened species (CBD)	No information	Medium	High	No Information	High	No Information
Vulnerability (CBD)	High	High	High	Low	Low	No Information
Productivity (CBD)	High	High	Medium	Medium	High	Low
Diversity (CBD)	High	High	High	Medium	High	Low
Naturalness (DFO/CBD)	High	Medium	Medium	Medium	Medium	High
Aggregation (DFO)	High	Medium	High	Medium	High	No Information
EBSA Identification	**Meets criteria**	**Meets criteria**	**Meets criteria**	**Meets criteria**	**Meets criteria**	**Does not meet criteria**

Hydrothermal Vents

Globally, and in the Offshore Pacific Bioregion, hydrothermal vents represent a rare and unique geological feature associated with the spreading of tectonic plates. The hydrothermal vents in the Offshore Pacific Bioregion are located on the Northeast Pacific ridge system, a mid-ocean spreading ridge located west of Vancouver Island. With the exception of Baby Bare Seamount, all known hydrothermal vent fields in the northeast Pacific Ocean occur within 33 km of the main ridge and fault axes. Of the vents found on the Northeast Pacific ridge system in Canadian waters, 11 are confirmed active, 4 are inferred active, and 3 are inactive. In addition to differences in geothermal activity, vent sites vary considerably in terms of area, species composition, depth, and other factors. Vent fields are known to vary in physical, chemical, and biological attributes but all of them meet EBSA criteria and all were treated as part of a single EBSA that encompasses two areas (Figure 2).

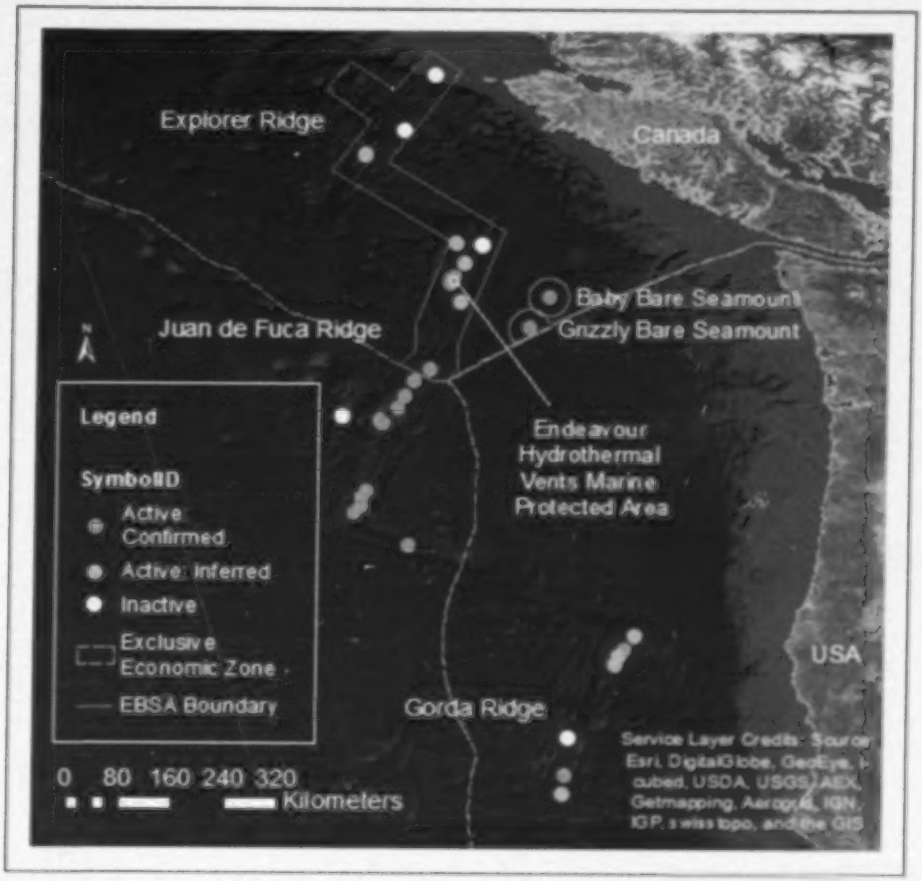

Figure 2. Location of known vent fields (solid circles) and boundaries of the Hydrothermal Vents EBSA within Canadian waters, delineated by the open red polygon and open red circles.

Hydrothermal vents scored as "high" on all EBSA criteria except for importance for threatened and endangered species, for which insufficient information exists (Table 2). The EBSA encompasses all active and inactive hydrothermal vents, the hydrothermal plume above them, the substrate and hydrothermal cells beneath them, the rift valleys within which new vents may form with tectonic movement, and all of the flora and fauna associated with these features. Inactive vent fields were included as part of the EBSA because they host novel species assemblages and geomorphic features even after venting has ceased.

The EBSA comprises two areas: the first area includes within its boundaries all vents within 33 km of the main ridge and fault axes (i.e. the maximum distance at which a vent has been found from the ridge) and 300 m above the valley floor, which encompasses the hydrothermal plume. This EBSA boundary is intended to capture the potential emergence of new hydrothermal vents which may occur at unpredictable times, thereby safeguarding processes that lead to the development of new vents and associated communities. The second area includes a 30 km radius around the summits of Baby Bare and Grizzly Bare Seamounts and the water column above these footprints. The Baby Bare-Grizzly Bare Seamount complex is identified as a unique off-axis geothermal feature. This complex is a combination of vent and seamount and is particularly unique in the Offshore Pacific Bioregion.

Seamounts

A seamount is an underwater mountain that has an elevation of more than 1,000 m from the seafloor. Within waters of the Offshore Pacific Bioregion, there are 18 named seamounts with heights >1000 m, and perhaps as many as 36 seamounts in total. Bowie Seamount in Canadian waters and Cobb Seamount in international waters are two of only five shallow seamounts known to have summits within the euphotic zone in the northeast Pacific Ocean, and are among the best studied. Seamounts are features of considerable biological and oceanographic interest because of their distinct species assemblages and enhanced biological productivity.

Only named seamounts, including Baby Bare Seamount which is also identified as part of a hydrothermal vent EBSA (Baby Bare-Grizzly Bare complex) were identified as EBSAs in this process due to uncertainties associated with the existence of unnamed seamounts identified through analysis of limited bathymetry data. Should additional seamounts >1000 m in height be confirmed with new data, these should be deemed to also meet criteria for identification as EBSAs.

Seamounts were identified as EBSAs primarily on the basis of their regional uniqueness, and ranked highly in terms of vulnerability, productivity and diversity (Table 2).

In its identification of EBSAs in the North Pacific Ocean, the CBD workshop participants (CBD 2014) specified that the boundaries of seamount EBSAs encompass the entire seamount footprint area from the surrounding abyssal plain to the summit, as well as the water column above the seamount footprint. In Canadian waters, there is a paucity of high resolution bathymetric data to define the area of seamount footprints. Thus, the radius of oceanographic influence of the Taylor cone associated with Cobb Seamount, 30 km, was used to establish the boundary around each named seamount summit in the Offshore Pacific Bioregion (Figure 3). It is recognized that this radius may be overestimated for seamounts with small footprints and small zones of influence, or underestimated for seamounts with large footprints or large zones of influence. Additional biological and oceanographic studies of seamounts could help refine these boundaries, as would finer resolution bathymetry.

Named seamounts from BC Marine Conservation Analysis (2011) and Interridge Vents Database 2.2 (2010)

Figure 3. Boundaries of the Seamount EBSAs in Canada's Offshore Pacific Bioregion.

Continental Slope

The continental slope is the area of the continental margin that lies between the continental shelf with typical depths of less than 200 m and the abyssal plains, with depths of ~2500 m, and its lower edge is generally less than 100 km offshore. Strong upwelling and downwelling occur seasonally and influence the distribution and abundance of slope-associated fauna such as groundfish, shellfish, and salmonids.

Much of what is known of the Continental Slope EBSA is based on biological survey data gathered mainly to the west of Vancouver Island. These data were primarily collected from relatively shallow depths using methods that have varied over time and area. There is relatively little biological information available for deeper parts of the slope (>1000 m).

In previous DFO EBSA assessments, Clarke and Jamieson (2006a and b) and Jamieson and Levesque (2014) identified EBSAs based on physiographic features that overlap partially with the continental slope EBSA identified here (Figure 4). These previous assessments concentrated on waters that overlie the continental slope at the shelf break. The present assessment focused primarily on evaluating benthic and demersal areas of the entire slope.

In this process, the entire continental slope was identified as an EBSA primarily on the basis of its importance for species aggregations and fitness of species or life history stages (Table 2). The slope ranked high for diversity, vulnerability and importance for threatened or endangered species. The boundaries of the slope EBSA correspond to the approximate depths from the shelf break to the foot of the slope.

A number of features within the slope were identified as potential EBSAs but there was insufficient information available to evaluate these features. For example, submarine canyons within the slope were highlighted as having ecological and biological importance, and other topographic features within may also be significant, such as ridges and valleys. Further research is recommended to evaluate the ecological or biological significance of these slope features.

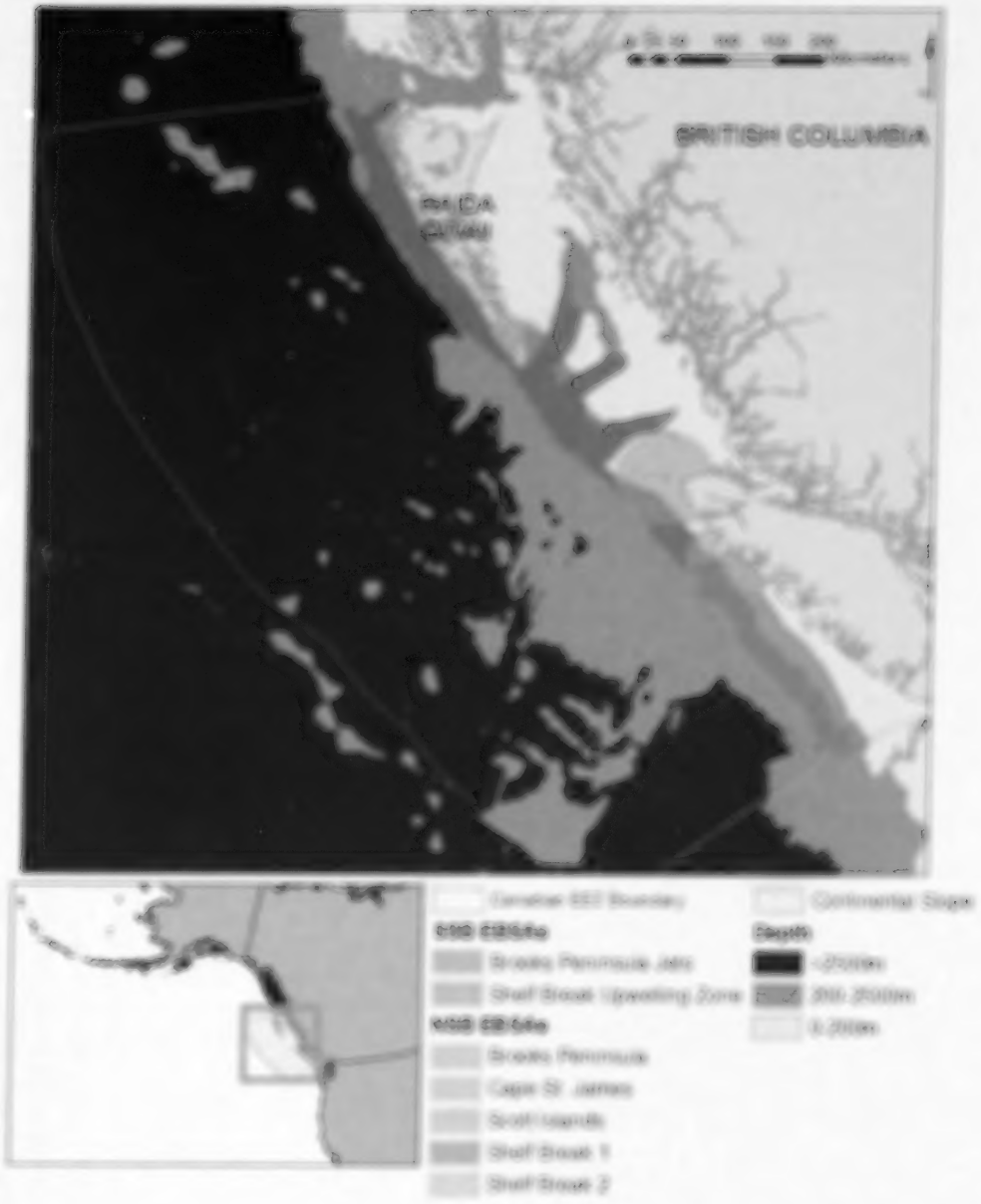

Figure 4. Boundary of the Continental Slope EBSA, and boundaries of EBSAs identified in Clarke and Jamieson (2006) and Jamieson and Levesque (2014) for the Southern Shelf Bioregion and Northern Shelf Bioregion.

Pelagic and Surface Waters

Important features within the pelagic and surface waters of the Offshore Pacific Bioregion are often ephemeral and dynamic, and include gyres, eddies, upwelling zones, and convergence and divergence areas. Two important features meet criteria for identification as EBSAs in pelagic waters: the Hawaii Eddy and the North Pacific Transition Zone.

The Hawaii Eddy EBSA is an important and unique ephemeral oceanographic feature in the Offshore Pacific Bioregion. The Hawaii Eddy was identified as an EBSA primarily on the basis of uniqueness, and ranked as medium for all other criteria, except vulnerability and importance for threatened or endangered species. Because the Hawaii Eddy's trajectories differ among years, its boundaries were defined to encompass previously documented trajectories.

The North Pacific Transition Zone (NPTZ) is a 3,000 km wide upper water column oceanographic feature bounded by thermohaline fronts, the Subarctic Frontal Zone in the north (40-43° N) and the Subtropical Frontal Zone in the south (28-30° N). This feature is a highly productive habitat that attracts aggregations of prey resources and pelagic predators, and serves as a migratory corridor for marine birds, mammals, and turtles. The NPTZ was identified as an EBSA primarily on the basis of its importance for species aggregations and fitness consequences for species or life history stages, but also ranked highly for its relative productivity, diversity, and importance to threatened or endangered species (Table 2). Its boundaries reflect the range of annual variability in occurrence and are consistent with the international NPTZ EBSA identified via the CBD (CBD 2014).

Figure 9. Boundaries of the Howe Sidy and North Pacific Transition Zone EBSAs

Bathypelagic and Abyssal Zone

The bathypelagic zone starts at depths greater than 1000 m and transitions to the abyssal pelagic zone beyond 2000 m. The abyssal zone is described as an expansive area of ocean floor and adjoining water column lying between depths of 3500 m and 6000 m. There are three named abyssal plains in the northeast Pacific Ocean; of these, the Cascadia Plain (2100 m to 3000 m) is the only one located inside the Canadian EEZ at the foot of the continental slope west of Vancouver Island, but this represents a small portion of the seafloor west of the continental slope.

The oceanography and marine biology of these waters is generally poorly characterized with scant information on biota, except where hydrothermal vents have been studied. Abyssal waters (i.e., below 2000 m) are generally thought to be an area of low biological productivity. However, given the limited knowledge about the abyssal zone and the expansive area involved, this habitat could support a substantial reservoir of biodiversity. For example, more than 90% of the polychaetes, copepods, isopods, and nematodes in a given sample taken from deep abyssal waters are typically undescribed.

The assessment of bathypelagic and abyssal zone features excluded habitats and features already considered in previous sections (i.e. hydrothermal vents, seamounts, and canyons, ridges and valleys associated with the slope).

Bathypelagic and abyssal areas were ranked as high on naturalness, primarily due to their extreme inaccessibility. All other criteria were ranked as low or as insufficient information to assess (Table 2). Thus, no EBSAs were identified in the bathypelagic and abyssal waters. Reassessment of this area as more information becomes available was recommended.

Sources of Uncertainty

Limited biological and environmental data in the Offshore Pacific Bioregion influenced the ability to assess some areas (e.g. abyssal plains). In addition, the quality and coverage of bathymetric data in the Offshore Pacific Bioregion limited the ability to identify some features (e.g. canyons that intersect the continental slope) and delineate accurate EBSA boundaries (e.g. seamount footprints). As a consequence, there may be unknown seamounts, hydrothermal vents and other ecologically or biologically significant features that have yet to be discovered, described, evaluated, and mapped.

Research to improve knowledge of the bathymetry and distribution of species is recommended to refine the location and boundaries of EBSAs in the Offshore Pacific Bioregion, especially for the continental slope, bathypelagic and abyssal zone, and seamounts.

New to this assessment in Pacific region was the inclusion of the CBD template and criteria. The template is used to organize available information and therefore justify the associated criteria ranking. The CBD template includes several additional EBSA criteria that were not included in previous DFO EBSA assessments in this region. It was encouraging that these additional criteria added increased richness to the assessment of each feature or area. However, some participants found the interpretation of the EBSA criteria challenging and recommend clearer guidance on the definitions for future assessments, as well as explicit approaches for incorporating uncertainty.

There is limited quantitative information available for the Offshore Pacific Bioregion and there is considerable variation in the quantity and quality of data across all assessed areas. Historical sampling and logistical constraints of sampling have resulted in better understanding of only representative sites of some Offshore Pacific Bioregion EBSAs. However, limited information

did not inhibit the evaluation of areas or features, except in the case of the Bathypelagic and Abyssal Zone.

Significant gaps in biological and environmental data were the key sources of uncertainty that affected at least some of the criteria rankings for all areas or features considered in this process. However, some criteria rankings were subject to more sources of uncertainty than others.

Overall, uniqueness and naturalness were relatively straightforward EBSA criteria to assess for all areas or features considered in this evaluation. All other EBSA criteria required, at a minimum, some knowledge or data on the relative abundances or distributions of species. In addition, the three criteria related to importance for species (including threatened, endangered or declining), their life history stages, or their fitness, required some knowledge or data on the degree of association or dependence on areas or features for all or part of their life cycle. Information on species occurrences and associations within particular areas or features are known for a relatively small proportion of taxa and areas of the Offshore Pacific Bioregion. While existing knowledge and information were extrapolated to under-sampled areas (DFO 2011), these data gaps mean that there may be EBSAs that have yet to be identified in the bioregion. They also mean that important details may be missing to optimally manage the biological or environmental processes or attributes that make these areas ecologically or biologically significant.

Some EBSAs comprise features that are likely to vary in the ways that they are ecologically and biologically significant and future research could help improve our knowledge of this variability. For instance, while all hydrothermal vents were identified as geologically, chemically, and biologically unique, vents differ widely in their chemical composition, environmental conditions, and community assemblages, and different geothermal processes underpin vent ecosystems within Canada. Seamounts too were all identified as unique features that are highly productive, diverse and vulnerable. However, the relative diversity and productivity of seamounts may differ according to summit depth and the extent to which seamount ecosystems interact with ecological processes in adjacent epipelagic waters. The degree of vulnerability and types of communities and habitats associated with seamounts are also anticipated to vary according to location and depth. Similarly, features within the continental slope, including canyons, ridges and valleys are expected to support different types of communities and differ in vulnerability according to depth. A better understanding of the ecological and biological attributes of EBSAs that make them significant will enhance the ability to manage activities and safeguard these attributes.

Two other sources of uncertainty were related to the boundaries of EBSAs identified. In some cases, boundaries are spatially and temporally dynamic over multiple temporal scales, while in others, the boundaries were not exactly known due to limited bathymetry. Three of the EBSAs identified are subject to dynamic processes that influence their locations over time. Haida Eddies and the North Pacific Transition Zone fluctuate according to complex oceanographic and climatic conditions, while the location of hydrothermal vents and vent fields can vary with short term variations in venting cells and structures or with longer term movement of tectonic plates. The exact current and future locations of these EBSAs are difficult to predict. To address these sources of uncertainty, a bounding box approach was used to capture the area within which these EBSAs are most likely to occur now and in the future. In contrast, the location of seamounts and the continental slope are more stable over time but their boundaries were difficult to specify due to the lack of high resolution bathymetry. In the case of seamounts, this uncertainty was addressed by defining the 30 km radius boundary around the summit of each named seamount. The boundaries of the continental slope EBSA were based on published definitions.

CONCLUSIONS AND ADVICE

- Six areas or types of features within the Offshore Pacific Bioregion were assessed against national (Fisheries and Oceans Canada, DFO) and international (Convention on Biological Diversity, CBD) criteria for identifying Ecologically and Biologically Significant Areas (EBSAs). The areas or types of features evaluated encompassed all marine habitats within the Offshore Pacific Bioregion, including those associated with hydrothermal vents, seamounts, continental slope, the seafloor, and the entire water column, including surface, pelagic, bathypelagic, and abyssal waters.
- Five EBSAs were identified: hydrothermal vents, seamounts, continental slope, Haida eddy, and the North Pacific Transition Zone. No EBSAs were identified in the bathypelagic and abyssal zone, in part due to insufficient information.
    - All hydrothermal vents were identified as EBSAs primarily on the basis of their global and regional uniqueness, and ranked highly on all criteria except importance for threatened or endangered species and/or habitats which had too little information for evaluation. Boundaries of this EBSA encompass all active and inactive hydrothermal vents within Canada's Offshore Pacific Bioregion, the hydrothermal plume above them, the substrate and hydrothermal cells beneath them, the rift valleys within which new vents may form with tectonic movement, and all of the fauna associated with these features.
    - Seamounts were identified as EBSAs primarily on the basis of their regional uniqueness, and ranked highly in terms of vulnerability, productivity and diversity. The entire seamount and the waters associated with them right up to the surface were identified as part of the seamount EBSAs. Due to limited bathymetry, the boundaries were defined by a 30 km radius around the summits of known seamounts. While all seamounts in Pacific Region would be EBSAs, only named seamounts were identified and mapped as EBSAs due to uncertainties associated with the existence of unnamed seamounts identified through analysis of limited bathymetry data.
    - The entire continental slope was identified as an EBSA primarily on the basis of its importance for species aggregations and fitness of species or life history stages. The slope is also highly diverse, vulnerable and important for threatened or endangered species. A number of features within the slope (e.g. canyons) were identified as potential EBSAs but insufficient information was available to evaluate these features against the EBSA criteria. Future assessments should examine these slope-associated features in greater detail. The boundaries of the slope EBSA correspond to the approximate depths of the shelf break and the foot of the slope.
    - The Haida Eddy was identified as an EBSA primarily on the basis of its regional uniqueness. Because the Haida Eddy's trajectory differs among years, its boundaries were defined to encompass known trajectories.
    - The North Pacific Transition Zone was identified as an EBSA primarily on the basis of its importance for species aggregations and fitness of species or life history stages, but also ranked highly for its relative productivity, diversity, and importance to threatened or endangered species. Its boundaries also reflect the range of annual variability in occurrence.
- New information should be incorporated into periodic assessments to improve rankings and refine identification of EBSAs and their boundaries.
- The combined CBD-DFO assessment methodology was considered effective for this scientific advisory process, with the additional CBD criteria providing a more robust evaluation and a richer rationale for decision making that is aligned with international processes.

SOURCES OF INFORMATION

This Science Advisory Report is from the February 11-12, 2015, Identification of Ecologically and Biologically Significant Areas (EBSAs) in the Pacific Offshore Bioregion. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

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